

Trend Study 27R-5-03

Study site name: Nephi Pasture Livestock Enclosure.

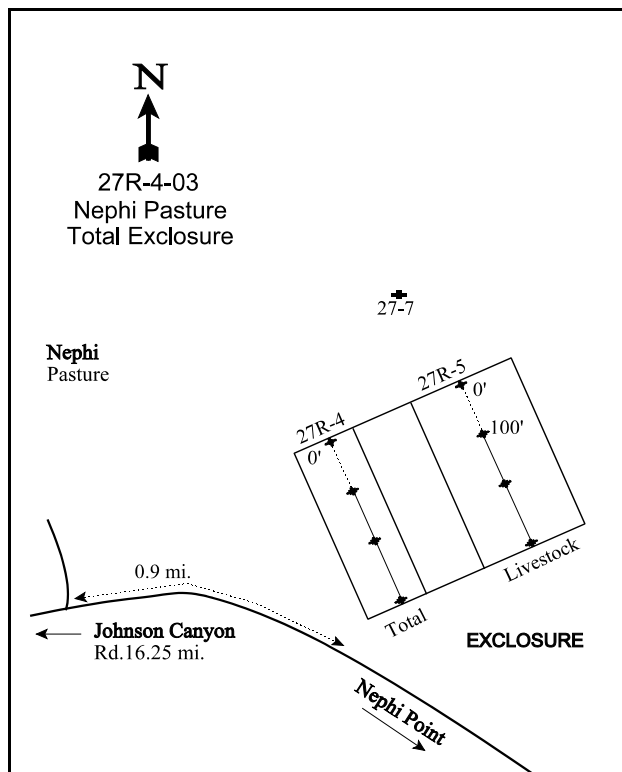
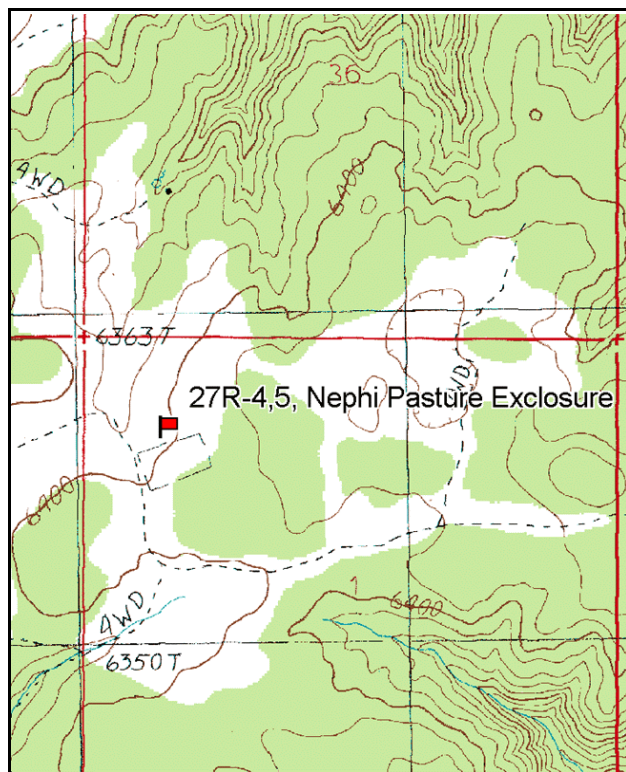
Vegetation type: P-J/ Big Sagebrush .

Compass bearing: frequency baseline 147 degrees magnetic.

Frequency belt placement: line 1 (11ft & 95 ft), line 2 (59ft), line 3 (34ft & 71 ft). No rebar.

LOCATION DESCRIPTION

From Kanab, take US 89 east for 9.4 miles to Johnson Canyon. Travel north up Johnson Canyon 9.75 miles to the Lock Ridge-Nephi Pasture road. Turn right and go 16.25 miles (see 27-6-03 for more detail) on the main road to a major intersection in Nephi Pasture. Continue straight towards Nephi Point, going 0.9 miles to an enclosure. Walk east along the fence on the north side of the enclosure to the beginning of the livestock enclosure (lower fence). From here, walk down to the midpoint of the fenceposts. The baseline starts on the inside of the livestock enclosure at the midpoint, and runs at an azimuth of 147 degrees magnetic.



Map Name: Nephi Point

Diagrammatic Sketch

Township 42S, Range 4W, Section 1

GPS: NAD 27, UTM 12S 4116620 N, 394319 E

DISCUSSION

Nephi Pasture Livestock Exclosure - Trend Study No. 27R-5

The Nephi Pasture exclosure complex was built in the 1960's and is found approximately 20 miles northeast of Kanab. This transect was established inside the livestock exclosure in 1998 as part of a 3-way comparison between the different exclosure grazing treatments. This transect is within 300 feet of the original Nephi Pasture study that samples outside the exclosure complex (27-7). The livestock exclosure is approximately 200 feet by 300 ft in size, about 1.4 acres. Slope varies from 5% to 10% with a northwest aspect at an elevation of nearly 6,400 feet. Deer utilize this exclosure heavily with use estimated at 111 days use/acre (274 ddu/ha) in 1998 and 169 days use/acre (418 ddu/ha) in 2003. Pellet groups in both surveys were primarily from the winter preceding sampling.

Soils inside the livestock exclosure are deep, sand in texture, and moderately acidic (pH of 5.8). Effective rooting depth was estimated at just over 20 inches with a compacted layer encountered at that depth. Phosphorus and potassium may be limiting to plant development and growth at 6.9 ppm and 12.8 ppm respectively. Minimum values for phosphorus are 10 ppm and 70 ppm for potassium. Rock and pavement are rare on the surface and within the profile. Erosion was minimal in 1998, but slight in 2003. Severe pedestalling around the base of shrubs as well as surface soil and litter movement provided evidence of erosion in 2003. Pellet group translocation also provided evidence of surface flows from recent rainstorms. Bare ground is moderate, but vegetation and litter have been adequate to limit erosion.

The livestock exclosure supports more shrub cover than either the total exclosure or outside the exclosure complex. The key species are basin big sagebrush, Utah serviceberry, and antelope bitterbrush. Sagebrush is the most abundant of the 3 species, but has the lowest preference for deer. Density of sagebrush was estimated at 3,340 plants/acre in 1998 and 2,420 plants/acre in 2003. In 1998, the young age class was abundant making up 22% of the population, and mature and decadent plants provided 44% and 34% of the age class respectively. As was the case inside the total exclosure, total sagebrush density declined in 2003, the number of dead plants increased, and the number of young declined. Sagebrush decadence nearly doubled inside the livestock exclosure in 2003 to 66%. The proportion of decadent sagebrush classified as dying was high in 1998 at 51% (~580 plants/acre), increasing in 2003 to 78% (~1,240 plants/acre). With this in mind, additional sagebrush die-off is likely. Utilization on sagebrush was light to moderate with 13% of the plants displaying heavy use in 1998. Use was much lighter on sagebrush inside the livestock exclosure in 2003. The proportion of the sagebrush population displaying poor vigor in 1998 was estimated at 18%, increasing to 51% in 2003.

Serviceberry numbered 740 plants/acre in 1998, declining to 540 in 2003. This population shows good recruitment in both 1998 and 2003 at 27% and 22% respectively, low decadence, and normal vigor. These plants are large averaging over 5 feet in height in 2003. Because of their size, a lot of the mature plants are partly unavailable to browsing which explains the relatively light use overall on serviceberry. Bitterbrush has a stable density of about 800 plants/acre. These plants showed light to moderate use in 1998, suggesting that the extremely heavy use outside the exclosure was due to dual cow/deer utilization. In 2003, use was heavy on 69% of the sampled plants inside the livestock exclosure. Bitterbrush vigor was mostly normal in both surveys, and decadence was low. In 2003, annual leader growth on shrubs was 5.2 inches for bitterbrush, 2.6 inches for serviceberry, and 2.3 inches for basin big sagebrush.

The only other common shrub in the livestock exclosure in 1998 was broom snakeweed which had an estimated density of 1,780 mostly mature plants/acre. Snakeweed density numbered only 120 plants/acre with drought in 2003. Point quarter data estimated 20 pinyon and 27 juniper trees/acre in 1998. Average basal diameter is 7.4 inches for pinyon and 6.8 inches for juniper. Most of these trees are in the 12 to 20 foot tall range.

The herbaceous understory inside the livestock enclosure provided 18% cover to the site in 1998. Several desirable perennial grasses were sampled including western wheatgrass, bluebunch wheatgrass, Indian ricegrass, mutton bluegrass, bottlebrush squirreltail, and needle-and-thread. Cheatgrass was the single most abundant species on the site in 1998 being sampled in just over half of the quadrats and providing 35% of the total grass cover. Sixweeks fescue was also abundant in 1998. With drought prior to and including the 2003 sampling year, all 6 of the perennial species listed above significantly decreased in nested frequency, and cheatgrass and sixweeks fescue were not sampled. Toadflax was the most abundant forb in 1998 and 2003, but did show a significant decline in frequency between years. Combined sum of nested frequency for perennial herbaceous species totaled 411 in 1998 but only 72 in 2003.

1998 APPARENT TREND ASSESSMENT

Trend for soil appears stable. Vegetation and litter cover are higher in the livestock enclosure compared to the total enclosure or outside. Percent bare ground is similar to the total enclosure at 23% but lower than outside (23% vs 31%). Erosion does not appear to be a problem. Trend for the key browse species, basin big sagebrush, serviceberry, and bitterbrush appear stable with higher densities compared to outside the enclosure. Serviceberry and bitterbrush display moderate use, good vigor and low decadence. Reproduction appears adequate to maintain the population. Sagebrush density is nearly two times higher in the livestock enclosure compared to outside. Forty percent of the population shows moderate or heavy use, although vigor is good on most plants and percent decadence is moderate at 34%. There are a large number of dead plants and half of the decadent sagebrush were classified as dying (~580 plants/acre). However, reproduction is currently appears adequate to maintain the stand. The herbaceous understory is more abundant in the livestock enclosure compared to outside. Total herbaceous cover is 18%. Annual grasses, cheatgrass and six weeks fescue, are abundant and provide half of the grass cover. Perennial grasses are also fairly abundant however. Forb diversity is similar compared to the total enclosure and outside. In addition, perennial forbs are more abundant in the livestock enclosure compared to outside. The most common species include bastard toadflax, silvery lupine, and wooly plantain.

2003 TREND ASSESSMENT

Trend for soil is down. An erosion condition class assessment rated soils as slightly eroding. Severe pedestalling and surface soil/litter movement provided evidence of erosion in 2003. Bare ground increased while vegetation cover declined considerably. Bitterbrush remained stable in density, and maintains good vigor and low decadence. The proportion of young bitterbrush declined from 28% to 7%. Serviceberry density declined from 740 plants/acre to 540 plants/acre in 2003, but young recruitment remains good at 22%, and vigor is normal on most plants. Changes in the sagebrush population are much worse than either serviceberry or bitterbrush. Sagebrush density declined by 28% in 2003, decadence increased to 66%, and the proportion of the decadent age class classified as dying increased to 78% (~1,240 plants/acre). The number of dead in the population nearly doubled in 2003, and young recruitment declined from 22% to 2%. Half of the sagebrush sampled in 2003 also displayed poor vigor. Individually, bitterbrush and serviceberry have stable trends while basin big sagebrush is down. Collectively, browse trend is slightly downward overall. Trend for the herbaceous understory is down. Perennial herbaceous sum of nested frequency declined 6 fold. The 6 most abundant perennial grasses sampled in 1998 all significantly declined in 2003 with drought. The one positive change for the understory that often accompanies drought was that cheatgrass was not sampled in 2003.

TREND ASSESSMENT

soil - down (1)

browse - slightly down (2)

herbaceous understory - down (1)

HERBACEOUS TRENDS --
Management unit 27R, Study no: 5

Type	Species	Nested Frequency		Average Cover %	
		'98	'03	'98	'03
G	Agropyron smithii	_b 99	_a 9	2.82	.04
G	Agropyron spicatum	_b 20	_a -	.60	-
G	Bromus tectorum (a)	_b 177	_a -	4.69	-
G	Oryzopsis hymenoides	_b 28	_a 2	.59	.15
G	Poa fendleriana	_b 41	_a 8	2.07	.48
G	Sitanion hystrix	_b 23	_a 1	.69	.00
G	Sporobolus cryptandrus	1	-	.00	.00
G	Stipa comata	_b 14	_a -	.07	.03
G	Vulpia octoflora (a)	_b 124	_a -	1.99	-
Total for Annual Grasses		301	0	6.68	0
Total for Perennial Grasses		226	20	6.87	0.71
Total for Grasses		527	20	13.55	0.71
F	Arabis spp.	5	-	.01	-
F	Astragalus spp.	7	-	.01	-
F	Calochortus nuttallii	-	5	-	.01
F	Comandra pallida	_b 143	_a 47	3.15	.68
F	Descurainia pinnata (a)	_b 11	_a -	.10	-
F	Draba spp. (a)	7	-	.01	-
F	Erigeron spp.	3	-	.00	-
F	Eriogonum racemosum	5	-	.01	-
F	Gilia spp. (a)	_a -	_b 17	-	.67
F	Lappula occidentalis (a)	5	-	.04	-
F	Lupinus argenteus	8	-	.57	-
F	Microsteris gracilis (a)	11	-	.02	-
F	Penstemon spp.	_b 14	_a -	.05	-
F	Plantago patagonica (a)	_b 45	_a -	.64	-
F	Polygonum douglasii (a)	1	-	.00	-
Total for Annual Forbs		80	17	0.82	0.67
Total for Perennial Forbs		185	52	3.81	0.69
Total for Forbs		265	69	4.64	1.37

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS --

Management unit 27R, Study no: 5

Type	Species	Strip Frequency		Average Cover %	
		'98	'03	'98	'03
B	Amelanchier utahensis	23	17	6.46	8.65
B	Artemisia tridentata tridentata	81	67	10.81	7.75
B	Gutierrezia sarothrae	36	5	2.20	.06
B	Juniperus osteosperma	3	3	1.72	1.21
B	Opuntia spp.	1	0	.03	-
B	Pinus edulis	0	0	.15	.15
B	Purshia tridentata	26	27	5.34	5.19
B	Ribes spp.	1	0	-	-
Total for Browse		171	119	26.72	23.02

CANOPY COVER, LINE INTERCEPT --

Management unit 27R, Study no: 5

Species	Percent Cover
	'03
Amelanchier utahensis	10.30
Artemisia tridentata tridentata	7.88
Gutierrezia sarothrae	.11
Juniperus osteosperma	2.86
Purshia tridentata	4.76

KEY BROWSE ANNUAL LEADER GROWTH --

Management unit 27R, Study no: 5

Species	Average leader growth (in)
	'03
Amelanchier utahensis	2.6
Artemisia tridentata tridentata	2.3
Purshia tridentata	5.2

POINT-QUARTER TREE DATA --

Management unit 27R, Study no: 5

Species	Trees per Acre		Average diameter (in)	
	'98	'03	'98	'03
Juniperus osteosperma	20	N/A	6.8	N/A
Pinus edulis	27	N/A	7.5	N/A

BASIC COVER --

Management unit 27R, Study no: 5

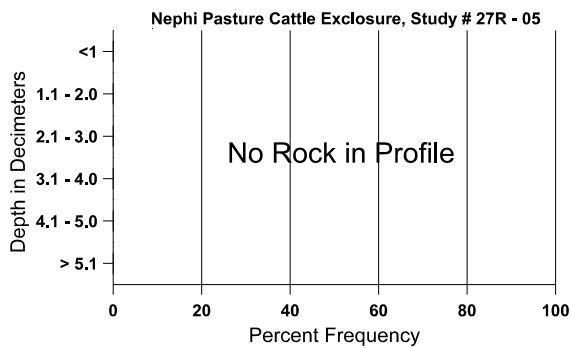
Cover Type	Average Cover %	
	'98	'03
Vegetation	47.41	25.80
Rock	0	.00
Litter	66.72	58.25
Cryptogams	1.73	1.35
Bare Ground	23.45	32.59

SOIL ANALYSIS DATA --

Management unit 27R, Study no: 5, Study Name: Nephi Pasture Livestock Exclosure

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
20.5	70.5 (17.7)	5.8	90.2	2.0	7.8	0.8	6.9	12.8	0.2

Stoniness Index



PELLET GROUP DATA --

Management unit 27R, Study no: 5

Type	Quadrat Frequency		Days use per acre (ha)	
	'98	'03	'98	'03
Rabbit	28	23	-	-
Elk	1	-	-	-
Deer	39	34	111 (274)	169 (418)

BROWSE CHARACTERISTICS --
Management unit 27R, Study no: 5

		Age class distribution (plants per acre)					Utilization				
Y e a r	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
Amelanchier utahensis											
98	740	100	200	460	80	120	30	3	11	8	49/56
03	540	40	120	380	40	80	7	22	7	4	61/64
Artemisia tridentata tridentata											
98	3340	180	740	1460	1140	1480	27	13	34	18	29/30
03	2420	-	60	760	1600	2560	12	4	66	51	32/34
Gutierrezia sarothrae											
98	1780	40	40	1740	-	-	0	0	0	0	11/12
03	120	-	-	100	20	-	0	0	17	17	11/11
Juniperus osteosperma											
98	60	-	60	-	-	-	0	0	0	0	-/-
03	60	-	40	-	20	-	0	0	33	0	-/-
Opuntia spp.											
98	20	-	-	20	-	-	0	0	-	0	6/4
03	0	-	-	-	-	-	0	0	-	0	-/-
Purshia tridentata											
98	800	20	220	500	80	20	38	0	10	8	33/48
03	840	-	60	640	140	20	29	69	17	5	30/46
Ribes spp.											
98	40	-	-	40	-	-	0	0	-	0	-/-
03	0	-	-	-	-	-	0	0	-	0	-/-

Nephi Pasture Exclosure Comparison Summary

Ground cover characteristics differ slightly between grazing effects. Bare ground is more abundant outside of the exclosure, and similar between the livestock and total exclosures in both 1998 and 2003. Vegetation and litter cover are highest in the livestock exclosure and lowest outside. Soil characteristics are similar between treatments. Soils are deep with sandy loam to sand textures, a moderately acidic pH, low organic matter content, deficient values for phosphorus and potassium, and high average soil temperatures. The total exclosure showed the least amount of erosion in 2003, while both the livestock exclosure and outside treatments showed slight erosion.

All sites support good stands of basin big sagebrush, bitterbrush, and serviceberry, with sagebrush being the most prevalent. In 1998, the sagebrush stand in the total exclosure was the least healthy followed closely by outside. Percent decadence was high at 64% in the total exclosure compared to 34% in the livestock exclosure and 46% outside. Vigor was poor on 46% of the total exclosure population, compared to 18% in the livestock, and 23% outside. Utilization was moderate to heavy outside and within the livestock exclosure. In 1998, deer use was significantly higher within the livestock exclosure (111 ddu/acre vs 64 ddu/acre) where sagebrush was in the best condition. With this in mind, it appeared that sagebrush was more effected by climate in 1998 than use. In 2003, sagebrush decadence was high in all 3 treatments at over 50%, with the highest level occurring inside the livestock exclosure. Poor vigor was also highest inside the livestock exclosure with 51% of the sagebrush being classified as such. Young recruitment for sagebrush was good in all 3 treatments in 1998, but very low in 2003. Density was highest inside the livestock exclosure in both surveys, but density estimates declined over all 3 treatments between 1998 and 2003.

Several factors appear to be effecting sagebrush at Nephi Pasture. Drought is likely the primary driving force behind deteriorating sagebrush health, but winter injury could also be a factor. Winter injury is presumably caused by freezing due to a lack of sufficient cold hardiness and/or winter drought or dessication (Nelson and Tiernan 1983). During mild winters, sagebrush can break dormancy during the middle of the winter and begin growth too early in the year. By doing so, sagebrush plants become susceptible to dessication and crown death if temperatures become very cold for any substantial length of time or there is a lack of soil moisture within the profile, especially within these deep sandy soils. In 2003, the livestock exclosure appears to be a little worse off than the other treatments. A plausible explanation is that heavy deer use as well as high intraspecific competition are additive factors effecting sagebrush in the livestock exclosure. Because overall browse density and average cover are highest inside the livestock exclosure, competition for resources would be greatest here, and this would be intensified during the current drought.

Bitterbrush density slightly declined in the total exclosure and outside, but remained stable in the livestock exclosure between 1998 and 2003. Serviceberry showed slight decreases in all 3 treatments in 2003. Although both species had increased decadence rates in 2003, the current levels are considered only moderate. Utilization has been on the moderate side for serviceberry in the livestock exclosure and outside, but more heavy on bitterbrush. However, vigor has been generally normal for both species across all treatments in both sampling years. Bitterbrush recruitment declined in all 3 treatments between 1998 and 2003, while young recruitment in the serviceberry population remained stable in the livestock exclosure and outside.

The herbaceous understories were similar with respect to species composition and overall production between grazing effects in 1998. With drought in 2003, grass production declined drastically on all 3 transects, with forb production declining in the livestock exclosure and outside, but remaining nearly the same inside the total exclosure. Sum of nested frequency of perennial herbaceous species declined across all 3 treatments in 2003 with the dry conditions. Cheatgrass had the highest frequency and cover values inside the total exclosure in 1998, but cheatgrass was not sampled in any of the 3 transects in 2003. Herbaceous trends are down on all 3 sites in 2003 due to the decline in perennial species.